

FAYE'S COMET.

CAMBRIDGE, U.S.				Equatoreal. (Professor W. C. Bond.)										
Cambridge M.T.				R.A.	Obs.	N.P.D.	Obs.							
1851.	h	m	s	h	m	s	h	m	s					
Jan. 1	8	3	53	a + 0	12	7	(6)	a + 1	16	2	(6)			
	4	7	9	54	22	39	14	12	(4)	94	15	17	(4)	Weisse, 870
Approximate value of <i>a</i> , a star of the 8th magnitude.														
R.A. 22 ^h 32 ^m 43 ^s										N.P.D. 94° 37'				

“The comet is a very faint object in our large equatoreal; when best seen it appeared slightly elongated in the direction of the sun.”

BOND'S COMET.

The stars used at Durham (see vol. xi. No. 1) corrected.

	Mean R.A. (1850).			Mean N.P.D.			No. of Obs.	
	h	m	s	°	'	"		
• Lalande, 14384	7	17	9.02	43	10	52.0	3	Set (1)
Anonymous	7	43	15.56	50	8	9.4	2	(2)
Lalande, 15636	7	53	33.16	52	26	57.8	2	(3)

		App. R.A.	App. N.P.D.
App. Place of (1) on Sept 13		^h _m ^s	^h _m ^s
	13	7 17 9.96	43 11 6.9
(2)	16	7 43 16.41	50 8 22.4
(3)	17	7 53 33.95	52 27 10.2

“These are meridian observations taken with the small transit circle of the Durham Observatory. Star (2) was almost too faint for the aperture of the telescope. There was an error of 1^m in its R.A. as previously assumed.”

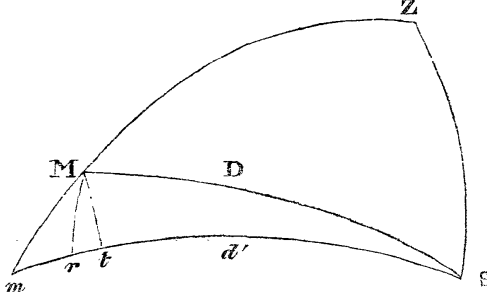
On a Method of Computing the small Corrections for clearing the Lunar Distance. By John Riddle, F.R.A.S.

“In the demonstration of this problem I have preferred to proceed by spherical trigonometry, as it enables us to see more plainly the several parts of the small differences sought for.

“As in correcting the distance separately for errors in places of the moon and of the sun or star, the formulæ for the corrections due to each object must be of precisely the same form and character, we shall suppose the effect of the parallax (when any exists) and of the refraction of the sun or star to be already allowed for (the formulæ for this purpose being given incidentally); and that it only remains to correct the observed distance for the parallax and refraction of the moon.

“Let then S be the true place of the sun or star, and M the true place of the moon, m being her apparent place, mM the correction of her altitude = p ; then Sm is the distance between the

true place of the sun or star and the apparent place of the moon, let $= d'$, and SM the true distance sought $= D$.



"If Mt be drawn perpendicular to mS , and Sr be equal to SM , then,

$$SM = Sm - mr = Sm - (mt - tr) = d' - (c_2 - c_3),$$

and thus $mt - tr$ is the correction required on account of the moon, which is to be subtracted from Sm or d' .

"Now $mt = mM \cos \angle m$, or representing mM by p and expressing the value of $\cos \angle m$ in terms of the altitudes and distance d'

$$c_2 = p \sin a' \sec b \operatorname{cosec} d' - p \tan b \cot d' \quad (1)$$

Where a' and b are respectively the true altitudes of the sun or star, and the apparent altitude of the moon.

"Similarly the corresponding term of the correction of the distance, on account of the sun or star, will be

$$c_1 = p' \sin b \sec a \operatorname{cosec} d - p' \tan a \cot d \quad (2)$$

a , b , and d , being the apparent altitudes and apparent distance, and p' the correction of the sun's or star's altitude: $d + c_1 = d'$.

"The quantities c_1 and c_2 are very readily found by using p and p' in seconds; logarithms of only four places, exclusive of the characteristic, are wanted.

"The correction c_1 is in all cases sufficient on account of the sun or star, the terms corresponding to tr or c_3 being inappreciable; but the neglect of this quantity with respect to the moon, may produce an error of several seconds in the distance.

Since $SM = Sr$; $\cos SM = \cos Sr = \cos (St + tr)$;

and $\cos SM = \cos St \cos tM$;

$$\therefore \cos St \cos tM = \cos St \cos tr - \sin St \sin tr.$$

Substituting $1 - 2 \sin^2 \frac{tM}{2}$, for $\cos tM$, and unity for the $\cos$ of the very small quantity tr , and reducing,

$$\sin tr = 2 \cot St \sin^2 \frac{tM}{2}$$

Now St is the distance corrected on account of the object at S , and once also on account of the moon; we denote it therefore by d'' , and then if tr and tM be supposed to be expressed in minutes and the equation be divided by $\sin 1'$, we have,

$$\begin{aligned}
 &\text{In minutes } t \text{ or } c_3 = \frac{1}{2} \cot d' (t M)^2 \sin 1' \\
 &\text{In seconds } c_3 = 30 \sin 1' \cot d'' (t M)^2 \\
 &\text{or since } (t M)^2 = (m M)^2 - (m t)^2 = (p^2 - c_2^2) \\
 &c_3 = 30 \sin 1' \cot d'' (p + c_2) (p - c_2),
 \end{aligned}$$

in which formula p and c_2 are still expressed in minutes.

"Now it so happens that $30 \sin 1' = .00873$, very nearly, and that this again differs from $\frac{1}{100} - \frac{1}{8} \frac{1}{100}$, by the small fraction $\frac{1}{50000}$ only; and when it is considered that the minutes in p and c_2 cannot exceed two figures each, the facility with which the value of the factors $30 \sin 1' (p + c_2) (p - c_2)$ can be computed, may be readily imagined. If we call this last quantity q ;

$$c_3 = q \cot d'',$$

and the entire correction on the moon's account is,

$$c_2 - c_3 = \{p \cdot \sin a' \sec b \operatorname{cosec} d' - p \tan b \cot d'\} - q \cot d'',$$

which is to be subtracted from d to give D .

Example.

$ \begin{aligned} a &= \odot \text{'s App. Alt. } 24^\circ 40' 0'' \\ &\quad \text{Correction } 1' 56'' = 116'' = p' \\ a' &= \odot \text{'s True Alt. } 24^\circ 38' 4'' \\ b &= \text{ } \text{'s App. Alt. } 16^\circ 53' 0'' \\ &\quad \text{Correction } 49' 28'' = 2968'' = p \\ d &= \text{App. Dist. } 111^\circ 27' 1'' \end{aligned} $	$ \begin{aligned} &\quad c_1 \qquad \qquad \qquad c_2 \\ \log p' &= 2.0645 - \log p = -2.0645 & \log p &= 3.4725 - \log p = -3.4725 \\ l \sin b &9.4630 & l \sin a' &9.6199 \\ l \sec a &0.0416 & l \tan &9.6620 & l \sec b &0.0191 & l \tan &9.4822 \\ l \operatorname{cosec} d &0.0312 & l \cotan &-9.5943 & l \operatorname{cosec} d' &0.0312 & l \cotan &-9.5946 \\ &1.6003 & &+ 1.3208 & &3.1427 & &+ 2.5493 \end{aligned} $
$ \begin{aligned} \text{Nat. Num.} &= +39''.8 \\ &+ 20.9 \\ \hline 60.7 &= c_1 = 1' 0''.7 \end{aligned} $	$ \begin{aligned} \text{Nat. Num.} &= 1389'' \\ &+ 354.2 \\ \hline 29' 3''.2 &= 1743.2 = c_2 \end{aligned} $
$ \begin{aligned} d &= 111^\circ 27' 1'' \\ + c_1 &\quad + 1' 0.7 \\ \hline d' &= 111^\circ 28' 1.7 \\ - c_2 &\quad - 29' 3.2 \\ \hline d'' &= 110^\circ 58' 58.5 \\ + c_3 &\quad - 5.3 \\ \hline D &= 110^\circ 58' 53.2 \end{aligned} $	$ \begin{aligned} p &= 49' \\ c_2 &= 29' \\ \text{Sum} &= 78' \\ \text{Diff.} &= 20' \\ .01 \times \text{Prod.} &= 15''.6 \\ - \frac{1}{8} &= -1.9 \\ \hline 13.7 & \log = 0.137 \\ l \cot d'' &= 9.583 \\ \log c_3 &= -9.720, c_3 = -5''.3 \end{aligned} $

True Distance. 13.7

“ The result of a very careful computation by the direct trigonometrical process, using Taylor’s logarithms to seven places, is $110^{\circ}58'53''$.

Examples.

App. Alt. Sun or Star.	Corr. Sun or Star.	App. Alt. of Moon.	Corr. of Moon’s Alt.	App. Dist.	True Dist. by Method above.	True Dist. by Spherics.
27 43	1 51	48 22	38 0	81 23 38	81 4 39.9	81 4 39.8
7 48	6 30	35 45	42 50	95 49 12	95 42 50.4	95 42 50.4
31 38	1 24	68 50	20 24	37 23 23	37 44 55.3	37 44 55
37 40	1 14	6 25	46 56	50 27 36	49 54 7.2	49 54 7.6

“ On the foregoing table I would observe that the true distances in the last column are worked with great care by Taylor’s logarithms to seven places, and that tenths of seconds are accounted for. In practice, this, of course, is never done ; but the result shows that the closer the computation by the direct process, the better appears the agreement with the simple method here proposed.

“ In conclusion, the expressions for c_1 and c_2 may be at once derived by differentiation, and, as far as they are concerned, the method is not new, having been employed *with the aid of special tables* in various ways and under various modifications, and in Lyons’ method the very formulæ are used.

“ But I am not aware of anything analogous to the method of finding the correction c_3 , on which the perfection of the process depends. This quantity c_3 will also be found to coincide with the result of a second differentiation, corresponding to the term of the second order in Taylor’s Theorem.

“ Allow me to notice an error in connexion with this subject in Baron Zach’s paper in vol. v. of our *Memoirs*.

“ The first example in the table of results I have given, is also the first worked in that paper, in which it is stated that the result exactly agrees with the trigonometrical process. This is not the case, they differ nearly seven seconds ; and on applying the necessary corrections to the data, and re-working as the author recommends, the result agrees within a few tenths of a second with that which I have given.”

Some astronomical and surveying instruments belonging to the late Capt. Copeland, R.N. and others, have been forwarded to the Society to be disposed of at very reasonable prices.

London :—Printed by G. BARCLAY, Castle St. Leicester Sq.